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CONTENTS

CHEMICALS

LASER ENERGY USED IN IMPROVED POLYVINYL CHLORIDE PRODUCTION

Frankfurt/Main FRANKFURTER RUNDSCHAU in German 4 Dec 80 p 26

[Article by Eugen Hintsches]

[Text] A new and effective tool in chemistry has now withstood another test: the laser beam. "A few kilograms" of vinyl chloride (VC), the raw material for the most frequently used plastic, polyvinyl chloride (PVC) have already been produced in the laboratory of the Max Planck Institute for Flow Research in Goettingen within the framework of the Special Research Section 93 "Photochemistry with Lasers."

Prof Juergen Wolfrum of the Goettingen Max Planck Institute for Flow Research explained: "Compared with the ordinary VC production methods, we can operate at lower temperatures, therefore with lower energy consumption, and still increase the yield by up to 20 percent, without the occurrence of the usual disturbing secondary products. The method is now ready for testing in a 1,000-ton pilot plant. We hope to have achieved a breakthrough for the use of lasers in industrial chemistry."

The use of lasers for VC production is, in the opinion of Prof Fritz Peter Schaefer, director of the Max Planck Institute for Biophysical Chemistry in Goettingen and head of the Laser Physics Section of the Institute, "one of the most interesting applications of laser chemistry from the economic viewpoint in the immediate future." And Prof Karl-Ludwig Kompa, director of the Project Group of Laser Research of the Max Planck Association of the future (from 1 January 1981) Max-Planck Institute for Quantum Optics in Garching in Munich, confirmed that: "Laser chemistry can now create a transition from the academic research sector to industrial chemistry."

Professor Kompa stressed that lasers "not only make chemistry more intelligent, they also open up totally new possibilities, which cannot be achieved with the traditional methods." Most chemical reactions start with the supply of energy. This generally increases the temperature. For example, after connecting a gas burner (Bunsen burner) the heat furnished is distributed more or less uniformly over all the molecules concerned, and excites them into rotations and oscillations.

This is illustrated by a graphic comparison. If the molecules are imagined as small balls, connected to each other on elastic springs, with the rise in the temperature all the balls begin to shake more strongly on their springs. Finally

the weakest springs are torn away and the balls released can react with other partners and produce new chemical compounds.

On the other hand, lasers work like selective Bunsen burners: they activate only selected balls and molecules in a mixture, and leave all the others unchanged in the process. Thus they prove to be extremely versatile new tools for chemistry: they provide concentrated light of approximately any desired wavelength. But the wavelength of the radiation characterizes its energy; the shorter the wavelength, the stronger the content of the individual energy packets (radiation quanta or photons) of the laser used and the more effectively one can influence a certain chemical conversion.

To pack the maximum energy into a molecule, the scientists need therefore the "hard" laser light of shortest possible wave, preferably in the ultraviolet (UV) range: it delimitates the visible light from the X-rays even richer in energy. The success of the Goettingen Flow Research Group has now for the first time made possible a new laser system: the Excimer-Laser.

The groundwork for this was achieved only in the last 5 years, among other places also in the FRG, in the Laser Physics Section of the Max Planck Institute for Biophysical Chemistry, Goettingen, by Dr Weng Chow, and in the Project Group for Laser Research of the Max Planck Association by Prof Herbert Walther. Meanwhile there already exists a whole "family" of such Excimer lasers. Their common characteristics are as follows: they operate with rare gases or mixtures of them, say with argon, krypton or xenon, and halogens such as chlorine or fluorine. Since these substances are chemically very inert in the combination, the cost of "pumping" them for them to produce laser light is very high: This can be achieved, for example, with strong electrical discharges or by bombardment with electron beams.

The concentrated application of pumped energy produces from the chemically inert rare gases, highly excited atoms, which can now be chemically bound with the halogens. Such states are called excimers or exciplexes. Naturally these states are stable only for a short time. After just a few billionths of a second, the excimers return to their original state, thereby giving off excess energy in the form of very short luminous flashes, as laser radiation in the ultraviolet range rich in energy: With such ultraviolet lasers a molecule may be excited with approximately 50 times more energy than, for example, with an infrared laser, say a carbon dioxide (CO^2)-laser. The Excimer-Laser is therefore also the core of the Goettingen Test Plant for VC production.

Professor Wolfrum of the Max Planck Institute for Flow Research stressed that "from the chemical viewpoint, the process is almost the same as before, only the start of the reaction is new, specifically with a laser." Previously in the VC process called "pyrolysis," the reaction chamber was heated uniformly to about 500 degrees Celsius. Moreover, additives (catalysts) are needed to implement the process. In these conditions, the conversion rate of vinyl chloride is between 50 and 60 percent; furthermore, many undesired secondary products occur, which have subsequently to be eliminated again by costly methods.

In comparison, the laser photolysis already operates at temperatures between 200 and 300 degrees Celsius; the vinyl chloride yield may be increased up to 20 percent, while, as confirmed by professor Wolfrum: "the purity of the reaction product is more than 99.9 percent. Our laser does not leave any residue, it operates therefore as a residue-free catalyst." Therefore, the VC synthesis started with laser beams is not subject to any corrosion problems or "poisoning" of the additives.

"With our test plant, we intend in the next 6 months to cover a complete spectrum of reaction parameters and investigate the effect of different temperatures and pressure conditions on the course of the reaction," said Professor Wolfrum. "Our experimental plant is not designed to produce large amounts, say to develop a technical reactor; but we can simulate the entire course of the reaction in a model reactor."

Dr Rainer Herbeck of the Garching Instrument GmbH, the Patent Evaluation Association of the Max Planck Association, believes that: "The transfer of fundamental research data on the production process exceeds the facilities of a Max Planck Institute, it is now a matter for the industry." Among other things, one must test how a relatively sensitive instrument such as the laser withstands the rough working conditions of a chemical production plant. But in this connection, the laser "was not the stumbling block of the production": With the currently available equipment, a small production plant could now already process 1,000 to 2,000 tons of VC per year.

The costs for this plant, which could for instance be operated as a branch--as by-pass reactor--of a large-scale technical plant, would amount, including the laser, to about 1 million marks.

Dr Herbeck said that: "The industry must first acquire experience before it can pass to even larger units. Experience also with regard to the possibility of using lasers not only for VC production, but preferably also for the production of other plastic raw materials, such as vinyl fluoride, tetrafluoroethylene, chloroprene, propylene or vinylidene chloride." The production of VC appears practically as the economically most attractive possibility. In 1978, 16 million tons were produced in altogether 107 plants all over the world. Thus PVC is the plastic produced in by far the largest quantities.

9018
CSO: 3102

ENERGY

SECOND SEMINAR HELD ON STATUS OF WIND ENERGY TECHNOLOGY

Dusseldorf BWK: BRENNSTOFF-WAERME-KRAFT in German Oct 80 pp 481-482

[Text] The second status seminar with over 25 papers gave the participants an opportunity--as did the first status seminar 2 years ago in Juelich--to get an overview of the results of research and development work accomplished in the FRG. That it was largely a discussion between technical people and only to a small extent a presentation of information to the general public might have been due to the fact that it was held concurrently with the status seminar on solar energy.

As stated by the Federal Ministry for Research and Technology, wind energy, as one of the renewable energy sources, will be able to make only a modest contribution to the energy supply of the FRG during the next 20 years; nonetheless, the development of more efficient installations is required to be able to enter the world market.

The structuring of the seminar according to topical groups corresponded, with the exception of meterological studies, to the wind-energy-converter performance areas which are to be developed within the scope of funded projects. Basic questions which cross project lines, like, for example, the limits of structural dynamic computing capability and material behavior at an extremely large number of load cycles in the presence of aggressive environmental conditions, could unfortunately not be discussed to the extent warranted by their technical importance.

In the area of large installations, German development is concentrated on the well known project GROWIAN I, a 3-MW wind energy converter which is expected to go into operation in 1982. Cost studies show that the conversion from wind energy into electrical energy with injection into the network can be achieved at an installation cost of DM 5,500 per installed kilowatt; this value will be lower with production of 100 units. The GROWIAN II project is based on the concept--not a new one--of the single-bladed rotor in recognition of the fact that the blades are the major cost item. A 6-month test of a 1/3-scale research installation is planned for next year.

The weight advantage from constructing the rotor blades with filament reinforced plastic compared to full steel spar construction was clearly shown by the data: 1.1 t for a 26 m and 23 t for a 50 m long blade. Since the light-weight construction appeared to be faced with difficult fabrication problems, tests will be done with steel construction to stay close to conventional technology.

The group of small wind energy converters was the center of great interest, much more so than at the official opening of the Pellworm test station on 27 June 1980. The reports covering construction and testing of installations with horizontal and vertical axes (Darrieus type) exemplify the problems in developing a method of construction and energy conversion which has to be suitably priced to acceptably meet the strongly growing demand. The investment cost per installed kilowatt, presently between DM 2,000 and DM 4,000 according to manufacturers' information, is not an adequate parameter for assessing an installation's annual productivity.

Unfortunately, the confused situation which involves the support policy of the Federal Government on the one hand and the routine blocking of construction permits via prevailing statutes on the other could not be discussed although several project reports provided a splendid basis for such discussion.

In connection with the meterological studies, two points are mentioned: A scientifically based study concerning the wind conditions at a location requires measurements over a 6-year period, and prediction of the wind velocity for a period of 1 to 2 hours is still subject to an error of 2 to 3 m/s. It would certainly be a mistake to delay application of wind energy converters until we can answer these questions with greater speed and accuracy. We cannot place such requirements on the developing countries; they are asking for energy not assured performance. Opportunities and methods for improving the transfer of our technology and experience were not discussed. Unfortunately, there was also no comparison with the development objectives and results of other countries in the area of wind energy utilization. Technical information exchange between the research and development groups financed by the government should in the future, in spite of understandable competitive situations, not be limited solely to the two-year cycle of status seminars. We should not have to fear that one day we will be shut out of world markets in a field where our pioneering effort is acknowledged.

9160
CSO: 3102

FIRM NEGOTIATES LARGE-SCALE EXPORT OF WIND POWER PLANTS

Copenhagen INFORMATION in Danish 4 Nov 80 p 7

[Article by "tm": "First Power Station Now Wants To Erect A Windmill"]

[Text] The first windmill the size of an electric power station is now being erected by Sonderjyllands Hojspaendingsvaerk in Abenra. At the same time, one of the largest Danish firms is moving into the wind-power branch of industry. That is the Volund concern, which has developed a 250-kW mill which will be powerful enough to supply a small town community or to make a significant contribution to the supply of electric power provided by a power company.

Director Jan Haahr of Volund has told INFORMATION that serious negotiations concerning the sale of this mill in the United States, the Netherlands and England are being conducted at present. He does not yet know how large the export program will be, but Volund has been offered several contracts provisionally, including one from the United States covering 100 mills. The price of each mill is expected to be between 1.8 and 2 million kroner when serious production starts, the director believes. The first mill will cost between 2.2 and 2.6 million kroner.

Volund wants to build a mill for Sonderjyllands Hojspaendingsvaerk within a year. It will be tested during the following 6 months. Volund is expected to start exporting windmills on or after 1 April 1982.

The height of the mill's tower is to be 27 meters and it will have a wing diameter of 28 meters.

No other Danish electric power stations have decided to make use of wind power.

9266
CSO: 3102

SOLAR ENERGY HIGHLIGHTED AT PARIS EXHIBITION

Paris ENERGIE in French 21 Oct 80 pp 15-16

[Text] The first solar village will be opened January 1981 at Melun-Senart (Seine-et-Marne), Michel d'Ornano, minister of environment and living conditions, announced Saturday, on inaugurating in Paris the third Exposition of Detached Housing. "This solar village, which will be first in the world, will contain the actual construction of the 7 prize-winning plans and 22 approved plans of the 5,000 solar houses contest conducted by my ministry," added Mr d'Ornano. Most of these plans have already been exhibited as models at the Exposition of Detached Housing, held until 26 October at the Palais des Congres.

Solar housing is without a doubt the star of the Exposition: constructors in fact are trying to demonstrate that a detached house can be energy efficient and economical to operate, contrary to its detractors' claims.

The Association of Detached Houses Contractors (SMI) moreover has concluded an agreement with the Ministry of Industry and Environment and the Solar Energy Commission in which it undertakes to encourage its members (50 percent of the builders of the houses in the catalog) to build at least 10 percent of their houses equipped with government approved individual solar hot water heaters. The technical approaches illustrated in the models shown go from water heating (30 percent) to air heating (25 percent) and to passive solar heating (a bioclimatic conception of the houses, with glass walls, southern exposure for living rooms, and buffer spaces: basements, garages to the north, cellars), as well as hybrid approaches mixing active and passive systems.

Outside the concern for insulation the models shown at this third Exposition present other characteristics, notably the reduction of sun surface which the designers sought to compensate by use of split-levels, for example; moreover, a wide range of options is often offered for the same model, mainly for the interior, exterior options being quite limited by building permit regulations. Finally, as a direct result of the development of the do-it-yourself preference in the French consumer, construction opportunities in "ready to finish" kits are increasing. The buyer who agrees to put in his flooring, wallpaper and plumbing can save from 10,000 to 35,000 Francs on the purchase price of his finished house.

Builders of detached houses should in the future increase productivity "by moving more and more toward group operations, integrating their projects with the public environment," declared the minister. This concern for productivity as well as for energy conservation is not lost on the builders, who are resolutely seeking formulas for group housing, villages especially, which number up to 100 houses, sometimes even approaching a small commune.

The French infatuation for detached housing has quite clearly grown in recent years since they now represent more than 65 percent of the total housing production in France, but it is clear that the public authorities today are firmly opposed to the spread of "housing blight" which has created such ravages in recent years, because of the added operational costs and demand for public services which it imposes on the community.

9772
CSO: 3102

ENERGY

WATER LENSES USED IN NEW SOLAR HEATING METHOD

Helsinki HUFVUDSTADSBLADET in Swedish 12 Dec 80 p 16

[Article by Sune Portin]

> [Text] Mauno Nokkala, a   engineer who lives in Sweden, says he has come upon a solution for effective utilization of solar energy. His invention is based on water-filled lenses which focus the sunlight on black balls filled with sodium phosphate at the focal point.

Engineer Nokkala's solution is reported to have obvious advantages as compared to the solar panels used heretofore. One of the disadvantages of the panels has been that a large part of the energy leaked back out into the air directly from the panels, in spite of the fact that they were covered with glass. Nokkala has solved that problem by covering the lenses with air-filled plastic balls. These let the sunlight through to the lenses, but the air in them prevents heat from leaking back into the air.

The whole system of air balls, lenses, and black balls is built into a "box" that insulates it against heat losses. This means that the solar cells can be used simultaneously as insulation of house walls or roofs.

"The system of lenses does not make the arrangement of the cells as important as before. In principle any south wall at all can be covered with them and they can utilize the sun's energy effectively," Nokkala explains.

As compared to the solar panels now on the market, this system is cheaper to install. For the material in the lenses and air balls is ordinary sheet plastic of a certain thickness.

Another problem with solar energy at our latitudes is the difficulty of using it when the need is greatest, i.e. in the winter, when the sun does not supply much heat.

Mauno Nokkala says that he has also solved this problem. For the black balls in the solar cells are filled with sodium phosphate, a substance that not only has a high melting point but also holds a great deal of heat. The heat accumulator should be placed under the house, where it is well protected from loss of heat. The accumulator itself would have three parts. In the innermost core there would be molten sodium phosphate or sodium nitrite. Around the core there would be a

heat reservoir of water pipes, and outside that an earthen heat reservoir. All of these reservoirs should be insulated from each other and also insulated on the outside.

"That way the sun's heat can be stored all winter," Nokkala asserts.

State Support

Only the future can show how good Mauno Kokkala's invention is, but he is not alone in believing in its possibilities. For 3 years he has been getting money from the Technical Development Board, an agency of the Swedish Ministry of Commerce and Industry. In Finland, too, he has been granted three different patents on certain parts of the solar cells, and has applied for a fourth.

On Thursday [11 December 1980] he lectured on his experiments at Åbo University at the invitation of Assistant Professor Martti Hämäläinen.

Old Idea

The idea of focusing the sunlight is not new. In the United States there have been experiments with large concave mirrors, with which temperatures of over 1,000°C have been attained at the focal point. Experiments with sodium phosphate have also been carried out in the United States previously. The new element in Nokkala's solar cells is the use of a cheap plastic material and water to produce a usable lens. Lens experiments have also been carried out in other parts of the world, but that technique has been considered too expensive, because glass lenses of the dimensions that would be required are very expensive and enormously heavy.

Last summer Nokkala succeeded in raising the temperature at the focal point of a 60 cm lens to 320°C. One of the disadvantages of the lens system has been the long focal lengths, but by bringing several lenses to bear on each other it is possible to reduce the focal length considerably.

8815
CSO: 3102

CITY TO GET FLUIDIZED-BED FURNACE FOR DISTRICT HEATING

Stockholm NY TEKNIK in Swedish 13 Nov 80 p 6

[Report of interview with Jan Olofsson and Erik Högberg by Tommie Ekström]

> [Text] Göteborg--Chalmers Technical Institute in Göteborg is the first in Sweden with a coal-fired fluidized bed furnace in a community heating station. In the fall of 1981 a 16 MW fluidized bed furnace will be connected with the community heating system.

Since 1977 Jan Olofsson and Erik Högberg of the Chalmers Institute for Energy Technology have been testing a 1 MW fluidized bed furnace.

"Next fall a 16 MW furnace will be put into operation at the institute," says Jan Olofsson. "8710 MW *[sic]* will be used to supply Chalmers with heat. The rest will go into the community heating system."

Coal is a suitable fuel for these "fluidized beds." In Chalmers's little experimental bed other fuels, such as chips, peat, and coke, have also been tried out.

"Of course, our furnace is designed for coal," says Erik Högberg. "But we wanted to see how alternative fuels functioned purely thermally.

"Chips, for example, which consist up to 80-90 percent of volatile substances, proved to produce high temperatures above the bed itself. No heat absorption in the bed itself could occur because of the low thermal coefficient of chips."

Much Slower

"Peat," says Jan, "behaved about the same way as chips. Coke was much slower. We got a higher temperature in the bed, because coke contains a low proportion of volatile substances."

The environmental questions will be evaluated in collaboration with the institute of organic chemistry. Experience indicates that with coal as fuel the system can reduce the sulfur dioxide content by 75 to 90 percent.

Generator AB, in Partille, joined Chalmers in applying for a permit to construct a 16 MW furnace back in 1977. While the authorities were considering this proposal Generator got an order to construct a fluidized bed for trash burning in Eksjö.

But now everything is ready for the Chalmers furnace, which will be in operation in 1981.

A multicyclon and textile filter keep down the emission. No smoke-gas purification in the form of a desulfurization installation is needed.

Very Small Beds

"The fluidized bed is really an old principle," Erik Högberg says. "In the beginning of the 1960's experiments were done with very small beds, and toward the middle of the 1970's larger installations were tested."

"But," says Jan Olofsson, "atmospheric (unpressurized) fluidized beds will still not be used for big power plants. On the other hand, there are no problems with installations up to about 20 MW. That means that they are very well suited for industrial plants or medium-sized community heating plants.

"Fluidized bed furnaces are cheaper where smoke-gas scrubbers are not needed, but above a certain size so many feeder lines into the furnace are needed that the installations become too big and costly."

Research assistants at Chalmers say that a temperature of 850°C needs to be maintained in a fluidized bed to keep down the sulfurous oxide emission.

There are also risks in having sand in the furnace.

"On one occasion we had caking in the bed. That occurred at 110°C."

8815
CSO: 3102

ENERGY

POSSIBILITY OF REPLACING OIL WITH NEW ENERGY SOURCES EVALUATED

West Berlin DEUTSCHES INSTITUT FUER WIRTSCHAFTSFORSCHUNG in German special issue 132, 1980 pp 44-57

[Paper by Urs Dolinski and Klaus-Dieter Labahn: "On the Problem of Replacing Petroleum Products With Other Energy Sources--As Exemplified in One of the Laender of the FRG"]

[Excerpt] 4.2.3. Possible Methods of Directly Replacing Petroleum Products With 'New' Energy Sources

4.2.3.1. General Remarks

The need to develop "new" energy sources arises not only from the energy-policy goal of finding substitutes for petroleum products but in particular is a consequence of the finiteness of petroleum and natural gas deposits as well as of the general need, if increasing future energy demands are to be met, for reliable and adequate energy sources.

The replacement of petroleum with "new" energy sources may be accomplished only over the long term because it is first necessary to solve a number of technological problems and to create the industrial conditions prerequisite for the large-scale use of these energy sources. It is precisely for this reason that it has already become necessary today to make suitable decisions with regard to measures which ought to be initiated.

At the present time it is difficult to judge the question of the economic use of new energy sources in Baden-Wuerttemberg. But with respect to reliability of supply and with respect to environmental acceptability we must consider, in our present state of knowledge, the following primary and secondary energy forms as possible energy sources replacing petroleum:

Primary energy forms:

1. Solar energy
2. Nuclear fusion energy
3. Other energy sources such as wind energy or geothermal energy

Secondary energy forms:

4. Coal enrichment products
5. Remote nuclear energy*
6. Hydrogen

We shall now briefly discuss these energy sources as possible substitutes for petroleum products.

4.2.3.2. Solar Energy

In solar energy we have at our disposal an inexhaustible energy source which is available in adequate supply. The energy radiated over the region of the FRG corresponds approximately to 80 times the primary energy presently consumed;[41] but for engineering reasons or economic reasons only a small portion of it is usable. Here the two essential constraining factors are on the one hand the low energy density of solar radiation amounting to about 0.4 megajoules/hr · m^2 (about 110 w/m^2 on an annual average) and on the other hand the diurnal and annual variations in sunshine--variations which are opposite to the variations in energy demand.

Solar energy can be used either thermally or electrically. For the near future the greater importance attaches to thermal use. This type of use ranges (see illustrative figure 3) from the low-temperature collector system (concentration factor C = 1, i.e., there is no collimation of the sun's rays) through the solar farm system (C = 10-100) up to the solar tower system (C = 400-1,000). Facilities based upon the solar farm or the solar tower system have thus far been constructed as prototypes or as pilot power plants. On the other hand more extensive low-temperature collector facilities have been built including among others the 16 solar structures funded by the German Federal Ministry for Research and Technology and listed in Table 11.

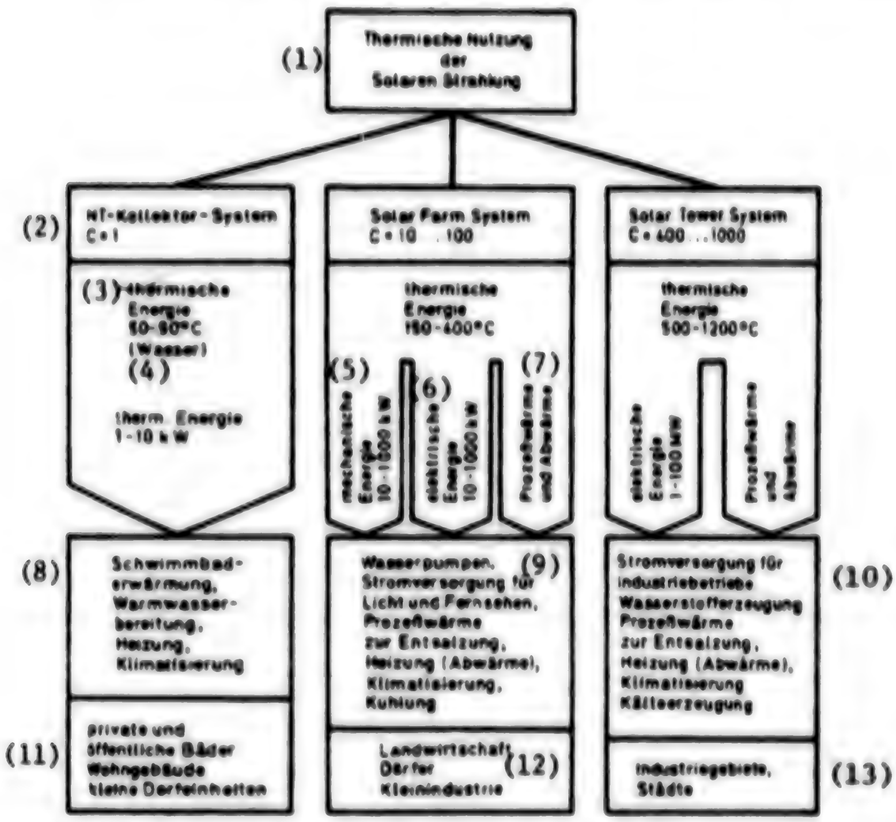
Electrical use can be achieved either via thermal (solar tower) systems or directly via photovoltaic process. However, in both these processes the area required in the FRG would be very great. At a conversion efficiency of 10 percent of the incident solar energy a power plant having an average power of 1,000 MW would require an area of about 100 km^2.

The useful potential for solar energy in the FRG is estimated to be about 0.2 percent[42] of the final energy requirement in 1990. If one applies this value to Baden-Wuerttemberg then this would correspond to an energy consumption of about 60,000 tons SKE [hard coal units] in the year 1976 and in 1990 about 80,000-90,000 tons SKE. Since solar energy should be used especially in those regions where because of the population distribution structure it is not suitable to supply heat using energy which is dependent upon supply lines, these values give an estimate of the order of magnitude

* See footnote 51.

in which petroleum products (and to a lesser degree also solid fuels) would be replaceable.

Figure 3. Possible Thermal Uses of Solar Radiation.



Source: M. Meliss, "Regenerative Energy Source," BRENNSTOFF-WAERME-KRAFT, April 1979.

Key:
1. Thermal use of solar radiation
2. NT-collector system
3. Thermal energy ...
4. (Water)
5. Mechanical energy ...
6. Electrical energy ...
7. Process heat and discharge heat
8. Swimming pool heating, water heating, interior heating, air conditioning
9. Water pumps, electric power supply for illumination and television, process heat for desalination, interior heating (discharge heat), air conditioning, cooling
10. Electrical power supply for industrial operations, production of hydrogen, interior heating (discharge heat), air conditioning, refrigeration

11. Private and public baths, apartment houses, small town units
12. Agriculture, villages, small industry
13. Industrial regions, cities

Table II: Solar-Heated Buildings in the FRG Promoted by the BMFT

	1	2
1 Aachen	Einfamilienhaus	WW, HZG, 20 m^2 evakuierter Röhrenkoll., 47 m^3 Sp, Wp, WRG
2 Essen	Einfamilienhaus	SB, WW, HZG, 69 m^2 Heatpipe- 3 Koll., 7 m^3 Sp, WP
3 Höhenkirchen	Einfamilienhaus	WW, HZG, 35 m^2 Flachkoll. 4, 4 m^3 Sp
4 Otterfing	Einfamilienhaus	SB, WW, HZG, 80 m^2 Flachkoll. 8 m^3 Sp, 100 m^3 Erdreich-Sp. 5
5 Esslingen	Einfamilienhaus	SB, WW, HZG, 9 m^2 Flachkoll., 3 m^3 Sp.
6 Salzhemmendorf	Einfamilienhaus	WW, 6 m^2 Flachkoll., 0,4 m^3 Sp.
7 Wahlstedt	wie 6	wie 6
8 Büdingen	wie 6	wie 6
9 Elsendorf	wie 6	wie 6
10 Walldorf	wie 6	wie 6
11 Titisee	wie 6	wie 6
12 Freiburg	10-Apartment-Haus 6	WW, HZG, 60 m^2 evakuierter Röhrenkoll., 23 m^2 Sp.
13 Bammental	Altersheim 7 (20 Personen)	WW, 30 m^2 Flachkoll., 1 m^3 Sp.
14 Heggbach	Invalidenheim 8 (450 Pers.)	WW, HZG, 900 m^2 Flachbaukoll., 20 m^3 Sp.
15 Unterensingen	Gymnasium 9	WW, 31 m^2 Flachkoll., 9 m^3 Sp.
16 Wiehl	Öffentl. 10 Sportanlage	SB, WW, HZG, 1600 m^2 Flachkoll., 210 m^3 Sp., WP, WRG

Source: M. Meliss, "Regenerative Energy Source," BRENNSTOFF-WARME-KRAFT 31 (1979) No 4, April, p 150.

Key:

1. Single-family home
2. Vacuum tube-type collector
3. Heatpipe collector
4. Flat-type collector
5. Ground storage
6. 10-apartment building
7. Home for the aged
8. Home for the disabled
9. Secondary school
10. Public sports facilities

WW--Hot water heating
HZG--Interior heating
Sp--Storage
Wp--Water pumps
SB--Swimming pool heating

4.2.3.3. Nuclear Fusion Energy

If processes of thermonuclear fusion were to attain economic feasibility and come into use on a large scale technologically then there would be available an almost inexhaustible energy potential which could not only guarantee the permanent reliability of the energy supply but also would permit to the greatest possible extent the energy supply's independence of fossil energy sources.

But despite research activity on many fronts the corresponding technologies are only now at the start of their development so that one can count upon their being used at the earliest in the first half of the coming century. Hence for our present study fusion energy has no significance.

4.2.3.4. Wind Energy

Apart from its possible local significance no importance worth mentioning can be attached to wind energy with regard to its possible uses as a substitute throughout the FRG.

It is true that in past centuries wind energy was employed as an important energy source in many stationary small installations (e.g., windmills) or in navigation but it was displaced by fossil energy sources. Its future utility for the energy supply (i.e., mainly in electrical power supply) of the FRG can at the present time be estimated only with difficulty, with the economic use of wind energy being assumed to be possible primarily in the coastal regions (Lower Saxony, Schleswig-Holstein) because of the high average wind velocities prevailing there.

Research projects in the area of wind energy are concentrated on the one hand upon the cheap assembly-line manufacture of small wind-energy installations, for example, for driving pumps and the like, and on the other hand upon the construction of large units for electrical energy production such as the big wind-power installation in Growian which could generate about 6 gigawatt-hours of current at an electrical power up to 3 megawatts with an average of 2,300 operating hours per year.[43]

4.3.2.5. Geothermal Energy

Geothermal energy occurs in the principal forms of dry steam, wet steam and hot water as well as a hot dry-system. Of course, in the FRG the geological thermal conditions required for the acquisition of geothermal energy are not especially favorable.

Steam deposits are unknown and hence here the production of electrical energy does not come into consideration.[44] On the other hand numerous thermal springs are known having a power (hitherto made use of only in thermal baths) which should be about 50 megawatts.

Geothermal investigations up to the present suggest the following picture of the conditions existing in Baden-Wuerttemberg with respect to possible utilization of geothermal energy:

i. In the Urach area (Schwaebische Alb) there exists a thermal anomaly which exhibits temperatures above 70° C at a depth of 1,000 m. Existing thermal waters are already being used to a limited extent.[45] There has been successful drilling aimed at using the geothermal energy and employing the single drill-hole system.[46] There has likewise been a successful completion of the fracture test required for the hot-dry-rock procedure employed (heating of pumped-in water by the existing hot dry rock); in this process artificial cracks and fissures are produced in the rock in order to increase the rock surface available for heat exchange.

ii. The Upper Rhine Valley trench is characterized by numerous geothermal anomalies. There are two storage sites available: the fault system at the two trench margins and porous-permeable rocks in the trench sediments themselves; petroleum drilling the Landau area has revealed an anomaly which attains as much as 100° C at a depth of 1,000 m and 150° C at 2,000 m. Economic feasibility calculations have shown that assuming the market price for hot water at the beginning of 1978 and assuming 9-percent interest for capitalization it would be possible to obtain an installed power of 14-17.5 megawatts.[47]

However, in the foreseeable future geothermal energy will probably make no significant contribution to the energy supply of the FRG and of Baden-Wuerttemberg.

4.2.3.6. Coal Enrichment Products

Hard and brown coal differ considerably (see above) in their conventional form as a direct substitute for petroleum products apart from their traditional use in the steel industry and in the electrical power industry. Replacement of petroleum by hard or brown coal is not to be expected until coals can be transformed into another energy form, i.e., can exhibit characteristics resembling those of the energy source being replaced (i.e., simple and clean manipulation, low transport costs, manifold application possibilities, similar heat costs).

This can be achieved partially by the conversion of solid fuels

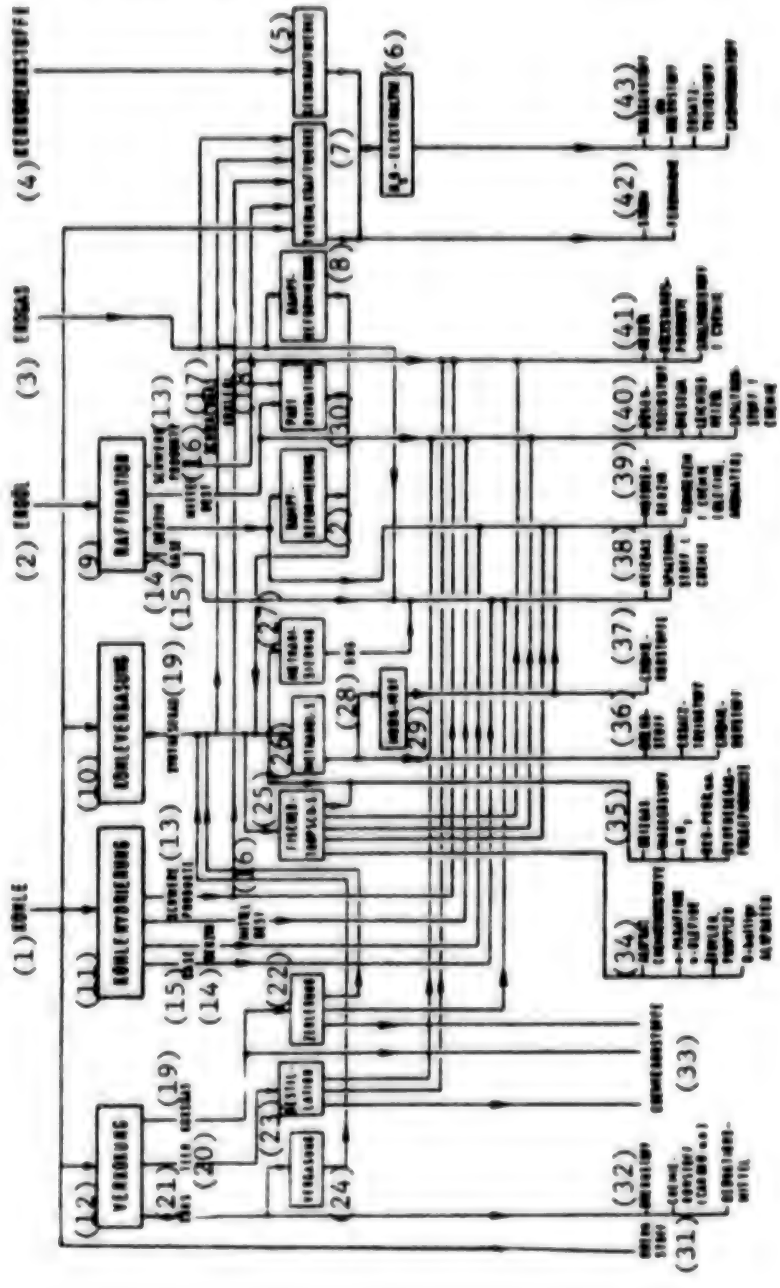
1. into the gaseous form and

2. into the fluid aggregate state.

This conversion can on the one hand be obtained directly through coal gasification and hydration but also on the other hand indirectly through decomposition of the coke gases arising during the preparation of coke or by the distillation of the tar which also arises in the same process. Illustrative figure 4 shows the different methods of using coal in the production of secondary energy sources and chemical raw materials.

There is attached a list of the coal gasification and hydration facilities which are already in operation or are under construction or are planned (status end of 1978).[48]

Illustrative Figure 4. Possible Ways of Using Coal in the Manufacture of Secondary Energy Sources and Chemical Raw Materials in Competition With Other Primary Energy Sources



Source: J. Schulze, "We Must Import," ENERGIE, No 7, July 1979.

Key:
1. Coal
2. Petroleum
3. Natural gas
4. Nuclear fuel
5. Nuclear power plants
6. Electrolysis of water
7. Thermal power plants
8. Steam regeneration
9. Refining
10. Coal gasification

Key to Figure 4 (continued)

11. Coal hydration
12. Coke manufacture
13. Heavy products
14. Gasoline
15. Gases
16. Intermediate distillates
17. Heavy gas
18. Coal oil
19. Coke gas
20. Tar
21. Coke
22. Decomposition
23. Distillation
24. Gasification
25. Fischer-Tropsch system
26. Methanol system
27. Methanization
28. SNG
29. Mobile process
30. Partial oxidation
31. Fuel
32. Fuel; chemical raw material (carbide et al.); reducers
33. Chemical raw materials
34. Aliphatic chemical raw materials; n-paraffins, n-olefins; ethylene, propylene; aliphatics containing oxygen
35. Heating gas; hydrogen; NH_3; oxo-prod. et al.; synthetic gas by-products
36. Fuel; propellant substitute; chemical raw material
37. Chemical raw materials
38. Heating gas; raw material fractions for chemistry
39. Engine gasoline; raw gasoline for chemistry (olefins, aromatics)
40. Jet fuel; diesel oil; light heating oil; raw material fractions for chemistry
41. Heating oil; residual products; raw material fractions for chemistry
42. Electric power; remotely supplied heat
43. Hydrogen as; fuel; substitute propellant; chemical raw material

4.2.3.6.1. Facilities for Coal Gasification

Solid-bed pressure gasification according to Lurgi up to a pressure of 100 bar. The coal throughput should range up to 7 tons per hour (Ruhr Gas Labor Union, AG/Ruhr Coal AG/STEAG AG--"Ruhr 100" Project). The test runs of this facility are expected to begin in 1979 when, however, the operating pressure will only amount to 25 bar. Not until after an operating time of 2 years will the pressure be raised to 100 bar.

Gasification of pellet size and compacted ballast coal in a solid-bed reactor (Coal Gas North Rhine GmbH, joint enterprise of the Sophie Jacoba Trade Union and Chemical Process Technology Planning GmbH). The coal throughput is said to amount to 1.6 tons per hour. Completion of the facility is expected in the beginning of 1980.

Coal dust pressurized gasification by the Texaco process (Ruhr Coal AG, Ruhr Chemistry AG). The facility has a throughput of 6 tons per hour and produces about 12,000 m^3/hr of gas. The tests were commenced in 1978.

Pressurized coal gasification in the airborne dust cloud following the Koppers-Totzek process (German Shell AG and Krupp-Kopper GmbH). The facility has a throughput of 6 tons per hour and was placed in operation in the beginning of 1978.

Pressurized gasification of fine coal in the slag-bath generator (Saarberg-Dr C. Otto Labor Union for Pressurized Coal Gasification). This Saarberg-Otto procedure works with a fluid slag bed. It was possible to begin the first test runs in the beginning of 1978.

Gasification of brown coal in a fluidized-bed reactor at high temperatures according to the Winkler process (Rhineland Brown Coal AG). The coal throughput amounts to as much as 1 ton per hour with about 1,500 m^3/hr of synthesis gas being generated, according to claims. The installation was placed in operation in the beginning of 1978.

Gasification of hard and brown coal using nuclear reactor heat (Mining Research GmbH, Society for High-Temperature Technology mbH, High-Temperature Reactor Construction GmbH, Julich Nuclear Research Facility GmbH, Rhineland Brown Coal Works AG). The semitechnical facilities existing at Mining Research GmbH and at the Rhineland Brown Coal Works AG have run for more than 1,000 hours and have supplied valuable basic data for a "reference" facility which at the present time is being planned for a throughput capability of 50 tons per hour.

In all coal gasification processes the energy content of the generated gas amounts to about 70 percent of the coal used. The mass ratio of coal used to raw gas acquired varies sharply depending upon the composition of the raw gas.

4.2.3.6.2. Facilities for Coal Fluidizing

In contrast to coal gasification, coal fluidizing has received a somewhat lower priority even though there also exists an absolute necessity for its further development. Here the production of chemical products occupies the foreground. The pilot facilities of Mining Research GmbH and of the Saarberg Works AG were run successfully last year and provided an abundance of basic data for the planned larger facilities.

Ruhr Coal AG as well as VEBA Oil AG are planning a demonstration facility having a daily coal throughput of 200 tons[49] for which the investment costs and the operating losses of the first year will be largely carried by government funding. Construction will commence in the beginning of 1979.[50] The commencement of operations is expected to be at the end of 1980.

The Federal Ministry for Research and Technology is also participating in the erection of a demonstration facility having a daily coal throughput of 6,000 tons in the United States. This facility for noncatalytic hydration of anthracite works by the Gulf II process at pressures from 70 to 140 bar and at a reaction temperature of 430° C. The aim is to produce low-sulfur heating oil for power plants. The Gulf Minerals and Resources Company is expected to operate it; at the same time there will be an involvement of German industrial interests (under contract to the Federal Ministry for Research and Technology) on the part of Ruhr Coal AG jointly with the STEAG AG. The planning studies are expected to be completed in 1979.

The Saar Mines Company is using public funds to erect a hydrating facility having a coal throughput of 6 tons per day. The process will be carried out at a pressure of 300 bar. The facility is expected to be in operation around the end of 1979.

The experimental operation of the mentioned facilities is expected to establish that it is even now technically possible by fluidizing coal to contribute to securing a reliable future energy and raw material supply.

4.2.3.7. Remote Nuclear Energy

Remote nuclear energy[51] permits an energy supply which is as independent as possible of fossil fuels. Since its potential uses extend to the realms of

i. space heating and hot-water heating,

ii. process heat up to 500° C as well as

iii. local electric power generation[52]

remote nuclear energy would also come to the fore as a substitute energy source replacing the petroleum products used for these applications.

Compared with remote heat supply, remote nuclear energy is characterized by the fact that it

1. can be "generated" largely irrespective of the location of the consumers (because of the possibility of cheaply transporting it over a distance) and because therefore it is outstandingly suitable for the construction of a network extending over a large area;

2. can be employed in the domain of process heat and for the generation of electrical energy at consumer centers.

However, the large-scale technical use of remote nuclear energy depends just as much as do the unconventional processes of coal enrichment upon the introduction of the high-temperature reactor. Thus it is the use [of the latter] which will also determine the earliest possible date at which remote nuclear energy can be employed. Thus one may not expect that remote nuclear energy will lead to a significant extension of the spectrum of energy sources on the energy market before the year 2000.

The first test facility in the domain of remote nuclear energy was set in operation in May of 1979 under the name Eve I/Adam I. In this system in the individual fission-pipe test facility (Eve I) by the introduction of helium at about 1,000° C (still electrically heated in the test facility) the methane/hydrogen gas mixture is transformed chemically into the energy-richer gas mixture carbon monoxide/hydrogen. This product gas is transported at ambient temperature to Adam I and there reconstituted as methane at temperatures up to 600° C. The transport cycle is closed when the methane is transported back to Eve I.

The large test and demonstration facility Eve II/Adam II is expected to be placed in operation at the end of 1979 and is looked upon as the final step before the construction of a nuclear prototype facility at the Julich Nuclear Research Facility.[53]

4.2.3.8. Hydrogen

In conjunction with the utilization of process heat from high-temperature reactors (possibly also from solar energy) it would be possible by means of a large-scale technical generation of hydrogen in the future to make available an additional significant substitute energy source. Here hydrogen as an energy source possesses a double advantage from the point of view of fossil fuel replacement:

1. It can be generated independently of fossil energy sources; its quantitative availability and hence its contribution to reliability of supply are limited only by the availability of the nuclear fuels required for the generation process.

2. Hydrogen can immediately replace fossil energy sources--in other words mineral oil products--in a number of areas of application.

Hydrogen can be used as an energy source:

1. in power plants for the generation of electric power (with the hydrogen being produced at a distance from the consumer and being usable close to the consumer with a low degree of environmental damage);

2. as a propellant fuel, i.e., in the transport sector;

3. generally as a useful fuel in the area of interior heating and process heat production.

Hence hydrogen has a substantial replacement potential. Since it must be positively evaluated from the point of view of reliability of supply--if the problem of long-term shortages of nuclear fuels can be solved by the use of fast breeders--and since the environmental damage associated with its production and distribution is comparatively low its use should depend in the future primarily upon whether it is possible to produce it economically on a large technological scale.

The earliest possible date at which hydrogen can be used on a large scale would probably not be in this century.

4.2.4. Summary Review of Possible Methods of Replacing Petroleum Products With Other Energy Sources

The preceding discussion shows that--in the visible future--the possibility of replacing petroleum products with other energy sources exists in principle but is in reality very limited.

Reasons for this conclusion:

-- Hard coal is certainly available in abundance but in the forms in which it is traditionally used it is because of certain ecological and economic disadvantages not a suitable replacement for petroleum products, especially not domestically and for certain other applications.

Over the short term and intermediate term the possible uses of anthracite as a replacement seem to be limited to the area of electric power generation. Of course, over the long term there will be replacement possibilities resulting from the use of enriched hard coal, especially as a substitute for natural gas or as a supplement to natural gas or also in some cases coal oil [may be used as a replacement].

-- Brown coal plays a role within the context of a systematic replacement of petroleum products in the domain of the final consumer in which it functions only indirectly as an ingredient in the manufacture of methanol. In the generation of electricity there is no immediate competition, as substitutes, between brown coal (base load) and heating oil (intermediate load and peak load).

The long-term significance of brown coal as a substitute energy source in its enriched forms is precisely the same as that of hard coal.

--Natural gas is in every respect the most suitable replacement of petroleum products as an energy source. However, limitations arise regionally in that economically the supply of natural gas, because of its association with supply lines, depends upon the presence of a certain consumer population density. Also, from the point of view of time, one must take into account that an expansion of the natural gas supply requires the time-intensive creation of appropriate infrastructural conditions. Over the

long term the use of this infrastructure and compensation for the limited availability of natural gas may be made possible by the supplementary use of synthesis gas.

-- Nuclear energy can replace petroleum products directly only in the generation of electricity. Only over the long term do there exist prospects for using the heat discharged by nuclear power plants for remote heat generation and prospects of using process heat from high-temperature reactors.

-- Electrical energy makes possible the replacement of petroleum products via two procedures:

a. by using the electrical power available during low-load periods in electrical stored-heat facilities and

b. in conjunction with the use of heat pumps.

-- Remote heat cannot only contribute to the replacement of petroleum among final energy consumers but also the use of such remote heat leads generally to improved primary energy utilization in the power plant domain. However, the actually realizable replacement potential is sharply limited over the short term and the intermediate term, especially in a regional sense. It is largely limited to regions where there is a high heat density which are already being supplied with remote heat.

Only over the long term may one expect that remote heat will also become significant in other regions as a replacement of petroleum. In any case while the required new construction is time-intensive it is also especially bound up with a very high investment outlay of uncertain profitability.[54]

-- "New" energy sources will come into the picture before 1990 as a replacement for petroleum products only to a very limited extent since there are still a multitude of both technological and economic problems to be solved. While the hydrogen economy, remote nuclear energy and nuclear fusion energy will probably not be usable until the next century we may also scarcely expect the use of enriched coal products before 1990. Prior to 1990 only the use of solar energy for the production of hot water and for space heating in the domestic sector can play a role (probably 0.2 percent of final energy consumption).

FOOTNOTES

41. Federal Ministry for Research and Technology [BMFT], "Energy Research and Energy Technology Program, 1977-1980," Bonn, 1977.

42. BMFT, ibid.

43. Bernd Stoy, "Wunschenergie Sonne" [Solar Energy Is the Ideal Energy], Energy Publishing House GmbH, Heidelberg, 1978, p 164.

44. German Federal Institute for Earth Sciences and Raw Materials, ibid., p 337.

45. G. Luettig, "Geothermal Energy and Its Prospective Role in Meeting the Energy Needs of the Future," BRENNSTOFF-WAERME-KRAFT, July 1978.

46. Here the heated water is taken out through the drill hole and the introduction of cold water takes place through a second pipe introduced into the drill hole.

47. G. Luettig, ibid., p 281.

48. H.-D. Schilling, "Coal Enrichment," BRENNSTOFF-WAERME-KRAFT, No 4, April 1979, p 127 ff.

49. Said to yield: 18 tons of fluid gas, 29 tons light oil, 69 tons middle-weight oil.

50. Construction was begun in May 1979.

51. By "remote nuclear energy" we understand procedures which make it possible to convert nuclear process heat into a suitable transportable form in order to separate the site of the nuclear reactor from the location of the energy consumer.

52. German Federal Ministry for Research and Technology, "Possible Replacement Uses of New Energy Systems," "Secondary Energy Systems" Program Study, Part IV, p 1.

53. BRENNSTOFF-WAERME-KRAFT, No 7, July 1979.

54. Fichtner, "Construction of a Remote Heat Supply System in the Middle Neckar Area," project study under contract with the Ministry of Economics, Small Business and Transport, Baden-Wuerttemberg, May 1979.

8008
CSO: 3102

POWER PLANT TO PRODUCE DISTRICT HEAT, METHANOL

Stockholm DAGENS NYHETER in Swedish 16 Dec 80 p 6

[Article by Lisa Ovesen: "Power Plant at Nynashamn to Give Heat and Methanol"]

[Text] At one end cheap "dirty" fuel is loaded in, such as high sulphur coal and residual oils. From the other end comes expensive heat in the form of hot water and gas which is brought by pipeline from Nynashamn to Stockholm. Furthermore methanol is produced, the fuel which may be used in the automobiles of the future.

This seemingly idealistic power plant is planned by Stor-Stockholms Energi AB, Stoseb, Nynas Petroleum, Sydkraft, and Svensk Metanolutveckling.

It will be finished in 1987, just north of Nynashamn, if everything goes as planned. It is not at all certain, however, as there has been no decision that Sweden will invest in the manufacture of methanol on a large scale.

Everything will stand or fall with the methanol production, which should finance the process, said Jan Erik Ryman, head of Stoseb.

Since 1978 four interested firms have worked on the purely technical aspects of how to derive both heat and "motor fuel."

The government authority for energy research has contributed 650,000 kronor. The head of this authority, Lars Rey, has called the project "interesting."

From now until 1983 an additional 20 million kronor will be invested in research which will eventually lead to a final investment decision in 1983, with construction to be completed in 1987.

Ships to Deliver Energy Combination

Deep draft ships will then be able to enter the new harbor right up to the plant in the Norviks area north of Nynashamn.

They will deliver high sulphur coal and residual oils--an energy combination which costs half as much as the more refined raw materials.

The energy combination will be gasified under high pressure and high temperature to produce fuel gas.

The high temperature will turn the ashes to slag which can be used for road building. Discharge of dust and heavy alloys will be "negligible" according to project leader Jan Erik Kignell from Nynas Petroleum.

The fuel gas which will be brought to Stockholm by pipeline is ·actically sulphur free, he also said.

The heat which will come to the benefit of Stockholm via pipe. .ill correspond to the burning of .5 million tons of fuel oil or .8 million tons of coal per year, and can supply one-seventh of the city.

But a precondition for the construction of the pipelines is that Sweden will invest in large scale production of methanol.

Can Produce Synthetic Gasoline

The Nynashamn plant will also be able to produce synthetic gasoline if the politicians decide for that instead.

Jan Erik Ryman of Stoseb said, "We have a wait-and-see policy. If there is no production of gasoline or methanol it is of course much cheaper to burn coal by conventional methods."

The planned hot water pipes from Forsmark are to a certain extent competitive with the Nynashamn plant, said Ryman.

"During the summer there will be too much heat. During the cold periods both will be needed."

"Then which will you invest in?"

"I will only say that the Nynashamn plant is one of three alternatives which we are now looking at. In addition to Forsmark we are also investigating the possibility of a large coal power plant at Vartan, Fittja, or Lovsta."

Nynashamn Plant a Project for the 90's

The coal power plant at Hammarbyhamn must be built regardless of whether the work goes ahead at Nynashamn. The future of the city's gas net is not dependent on the plant either, according to Jan Erik Ryman.

"By next year the authorities must decide about the net. Nynashamn is a project for the 90's. Gas is furthermore the most expensive of all the raw materials. It is absurd to use it to heat houses."

It is more difficult to make a judgment about gas stoves, said Jan Erik Ryman. There is so little gas in use that the subscribers are perhaps willing to pay a few hundred kronor more than electricity users.

In Stockholm 175,000 households have gas stoves, and 6,000 homes are heated with gas.

In 1987 500 persons will be employed at Nynashamn plant. During a 4-year period 2,500 workers will be needed to build the plant.

9287
CSO: 3102

BRIEFS

FIRST SOLAR POWER PLANT--The first Danish solar power plant installation will be located in the town of Vester Bogebjerg, between Korsor and Skelskor. That means that the last piece of the experimental project being carried out jointly by the electric power stations, the energy ministry and a private consortium consisting of Siemens, Varta Batterier and Dansk Energi Teknik, with EC support, will be put into place. It is calculated that the combined project will cost 17 million kroner and will form a part of a big investigation of the possibilities of solar energy in Europe. The fact that the first actual European solar power installation is being located in Denmark is due to the fact that the colder it is the better the so-called sun cells work. The amount of sunshine and a number of electrotechnological conditions were determining factors in regard to the placement of the installation. Among other things, it will be possible in practice for the town to be supplied with power by the plant. [Text] [Copenhagen BERLINGSKE TIDENDE in Danish 29 Nov 80 p 7] 9266

GIRAUD INCREASES FUNDS--In the field of energy substitutes for petroleum Mr Giraud seems to grant his aid to such privileged sectors as: solar energy where certain sectors (green energy, solar architecture, research and development in the thermal field) are increasing, and for which COMES [Solar Energy Commission] grants are increasing by 60 percent; geothermy with a 40 percent increase in financing; advancement and development of coal with a financing of 45 million francs; nuclear energy with a 13 percent increase in subsidies to the AEC [Atomic Energy Commission]. Certain priorities will be accorded to the objective of "nuclear protection and security," to the Tore Supra project (thermonuclear fusion) and to nuclear energy uses (superregenerators, perfecting PWR [pressurized water reactor] operation Thermos,(withdrawal of irradiated combustibles). Finally, the Energy Conservation Agency will develop its information and research program for new energy conservation equipment and procedures for which Mr Giraud plans a 25 percent increase in credits. [Text] [Paris SEMAINE DE L'ENERGIE in French 20 Oct 80 p 3] 9772

CSO: 3102

NEW STEEL DEVELOPED FOR 25 PERCENT LIGHTER AUTO BODIES

Stockholm TEKNIK I TIDEN in Swedish No 4, 1980 p 5

[Text] A new high-strength commercial steel--with excellent properties for the automobile industry in particular--has been under development for the last 4 years in cooperation between the Institute for Metal Research in Stockholm and SSAB [Swedish Steel Corporation]. SSAB is now building a plant in Borlänge that will be ready to operate in a year. Seven hundred million kronor is being invested in a production line that will produce high-strength steel for auto bodies, etc.

By virtue of the high strength and good plasticity, automobile components can be made 25 percent lighter. They can, moreover, be shaped with the same presses and tools that are used for conventional soft steel.

The silent material revolution, Prof Rune Lagneborg calls the development. He believes the new steel will give the Swedish steel industry--or at least parts of it--a new lift. In the United States it is being said that the new high-strength steel will be the salvation of Detroit.

Ford's materials experts say in a forecast that the new steel will give strip steel a fourfold increase from 1977 cars to 1985, or from 50 kg per car to 210 kg. [See Table 1, next page.]

Expressed in percentage of the weight of the car--a sixfold increase from 3 percent to 18 percent!

Thanks to a close collaboration between the Metal Research Institute and SSAB, Sweden is far ahead in competition for the new market sectors. Both Volvo and Saab have tested the new high-strength steel, according to reports with good results.

Quite Unique

Prof Lagneborg says that its taking only 5 years from the start of a research and development project to large-scale production is quite unique.

That is the length of time that it usually takes for a simpler invention to appear on the market, unsteady on its feet as a rule.

Table 1. Material Mix in the Average Automobile

	1977		1985	
Material	%	kg	%	kg
Cast Iron	17	290	10	118
Steel: High-Strength	3	50	18	210
Steel: Non-High-Strength	59	1,002	41	484
Aluminum	3	50	8	95
Plastic	5	86	10	118
Other	13	222	13	154
Total Net Weight		1,700		1,179
Total Weight in Service*		1,905		1,361

*Including gasoline, oil, baggage, and passengers.
Source: Ford Motor Company, December 1978.

This table from Ford shows what the materials specialists there think the development over the next few years will be for Ford cars. A similar development can probably be expected in Europe. The underscored line represents the new high-strength steel.

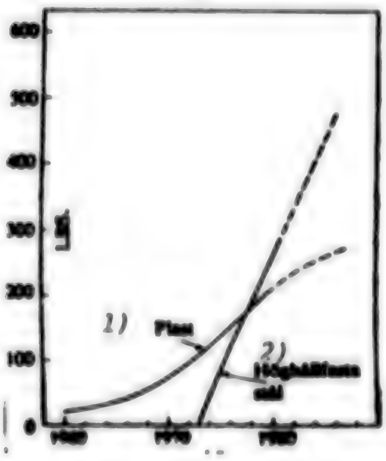


Figure 1. This is what the automobile people in the United States think the relation between plastic and high-strength steel will be for the next few years. Both are increasing, but high-strength steel is increasing more.
1) Plastic
2) High-strength steel

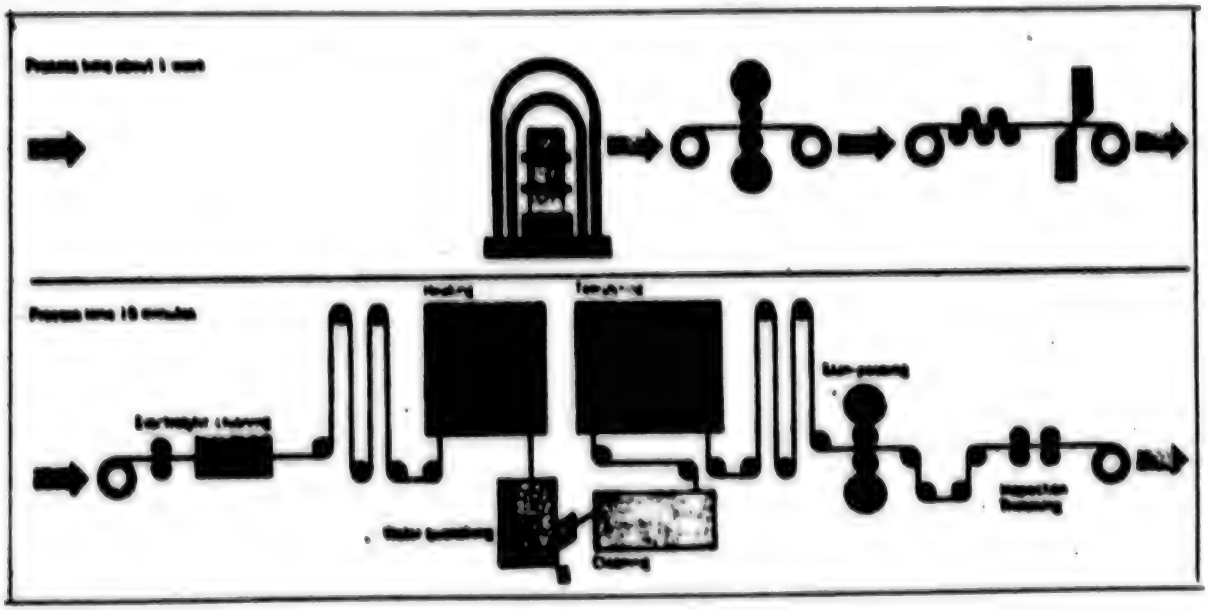
It is also noteworthy that the SSAB management decided to invest so heavily in the new steel during the period that the company was being established and going through its "changeable" period. Since then a number of research assignments have been carried out at the Metal Research Institute and at SSAB to find a "Swedish way" for the new steel.

All of this started at a congress in New York in the mid 1970's. Prof Lagneborg was there, together with some of his colleagues. A Japanese research group presented a report there on certain results that had been obtained partly by means of an unconventional method of heat treatment.

Lighter Cars

It was clear to the experts that their ideas and results were just what the market demanded, especially in view of the demand in the United States for lighter, energy-saving cars.

Higher-strength steel, which permits thinner structural parts without losing its plasticity, means lighter automobiles. And that the steel becomes highly competitive as compared to plastics and other modern materials.



The New Production Lines at Borlånge

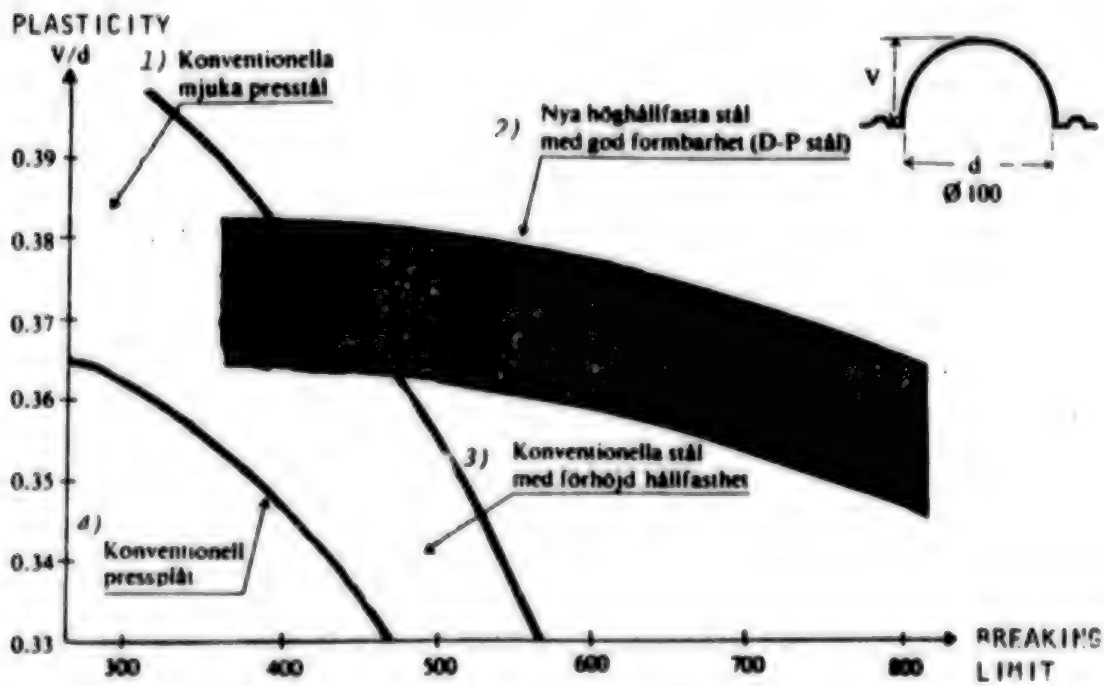


Figure 2. Plasticity of conventional compressed plate (the blue band) and of the new high-strength steel of good plasticity (the red band) at differing strength. *1)* Conventional soft compressed steel. *2)* New high-strength steel of good plasticity (D-P steel). *3)* Conventional steel with increased elasticity. *2)* Conventional compressed

Table 2. Cost per kg of weight saved per car with various alternatives to conventional steel.

High-strength steel (DP steel)	0.90 kronor/kg
Aluminum	15/6 kronor/kg
Plastic-based fiber composition	18.8 kronor/kg
Ditto, advanced	47.3 kronor/kg

The idea of the new steel can be described approximately as follows:

If low-carbon steel is heated to temperatures below 750°C and then slowly cooled, tough grains are formed in the steel structure--ferrite.

If it is heated to about 900°C and then cooled quickly, hard crystals are obtained in the structure--martensite.

What the Japanese researchers did was to heat the steel to a temperature between 750° and 900°C and then cool it at a well-controlled rate. In this way a steel was obtained with a ferritic groundmass containing inclusions of martensite, which gave a combination of high strength and good plasticity.

It was also found that the properties of the steel could be improved with small amounts of alloy metals, principally vanadium (some hundredths of one percent) and other alloy metals.

The lecture led to a big research effort, chiefly in the United States (and, of course, Japan), but also at the Metal Research Institute in Stockholm. And the new possibilities were immediately recognized at SSAB.

Now a Swedish process has been developed that is precisely tailored to our needs. At Domnarvet a hot-rolling mill is being built that will be ready to operate in 1981. The tests that have been done show that the technique has an enormous future potential.

Prof Lagneborg says:

"I myself think that the new rolling mill and the new high-strength strip steel will be the injection that will give SSAB a sound economy in the foreseeable future. The steel has such fine properties that it will find applications in many fields and not just in the automobile industry.

"What is especially interesting is that the Swedish steel industry is really in it from the beginning. Here in Europe, only Belgium has joined in. That should give SSAB great opportunities for sizable exports to the European automobile industry within a few years."

8815
CSO: 3102

BRIEFS

FUNDS FOR STEEL PROCESS--The board of the Industrial Fund has decided to lend 7 million kronor to SKF [Swedish Roller Bearing Works] to develop the plasma smelting method, a new pig iron process. Boliden's request for a loan for the INRED method has been postponed until 15 December to await more documentation from the firm. It is still too early to assign priorities among the various Swedish methods of pig iron production, the Industrial Fund says. Additional development work and market studies are needed. [Text] [Stockholm NY TEKNIK in Swedish 13 Nov 80 p 4] 8815

CSO: 3102

BRIEFS

DANISH-BUILT AUTOMOBILE--An engineer is going to present the first automobile built in Denmark in recent times today in Aabenraa. According to the engineer, it is a real automobile which is driven by a gasoline engine. Engineer Bent Due has been working on the automobile secretly for 4 years, but today it is ready to be presented to the public. Due says that the car gets 16 kilometers to a liter of fuel at 60 km/hr and that it is made of fiber glass. Due has already concluded a deal for it, which he says is being placed in Roskilde. The price of the automobile will be 32,000 kroner, plus value-added tax. Bent Due also says that the car is to be put into production in this country, although the engine is to be imported. The creator of the Danish light-weight automobile is demonstrating three prototypes of the new Danish automobile at an exhibition in Aabenraa this morning. [Text] [Copenhagen BERLINGSKE TIDENDE in Danish 5 Dec 80 p 1] 9266

VOLVO METHANOL ENGINES--Volvo will manufacture 50 methanol-driven motors in a preliminary series. The production will begin in about 1.5 years. The motors will develop 178 kW (242 horsepower) and will run on a mixture of 80 percent methanol and 20 percent diesel oil. The motors will be used in buses. Right now two methanol-driven Volvo buses are running in Stockholm as an experiment. The new preliminary series is based on the experimental buses. Volvo was previously doubtful about manufacturing methanol motors but has now changed its mind. [Text] [Stockholm NY TEKNIK in Swedish 20 Oct 80 p 7] 8815

FIRST AIRSHIP ORDER--Great Britain--Airship Industries, on the Isle of Man, has gotten its first big order for airships. The airships will be 200 meters long and have a cargo space of over 1,000 m^3. They can carry up to 60 tons of freight. The four airships ordered will be used in traffic over the Atlantic and to countries in Afirca and the Middle East. They cost 40 million [Swedish] kronor each. [Text] [Stockholm NY TEKNIK in Swedish 11 Sep 80 p 24] 8815

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